C.R. Bard, Mass Balance Calculations for Toxic Release Inventory (TRI) Form R Reporting

Facility: Madison, GA — **Use this to report 2018**

Reporting year: 2018 — All non 14, 34, 44 — Cycle 14, 34, 44

Input data requiring annual update:					Total
Quantity of bad drums returned	1		Obtain this from operations / purchasing personnel	0	1
Weight in partial drums returned	0	lb	Obtain this from operations / purchasing personnel	0 lb	0
Ethylene oxide usage	198,952	lb/yr	Obtain this from operations / purchasing personnel	25,769 lb/yr	224,721
Number of Cycles (Cycle 7, 12, 26, 28, 34, 73, 75, 85)	1,934		Obtain this from operations personnel	0	1,934
Number of Cycles (Cycle 8, 14, 34, 44, 74)	19		Obtain this from operations personnel	465	484

Input data to review, but may not have changed:					
EO accidental release, Cycle 7	0	lb	Update only if there was an accidental release of EO	0 lb	0
EO accidental release, Cycle 8	0	lb	Update only if there was an accidental release of EO	0 lb	0
Sterilizer removal efficency	99.1%		Update only if an efficiency	99.1%	
RTO efficency, aeration	99.73%		Performance Test was	99.73%	
RTO efficency, vessels	99.99950%		performed during the year, per	99.99950%	
Product transfer time, sterilizer to aeration	5	min	Update only if there have been	5 min	
Aeration time, Cycle 7	17	hr	changes to process durations	18 hr	
Aeration time, Cycle 8	20	hr	during the year	18 hr	
Unload time	30	min		30 min	

Online report data:						
Form R section	Form R section description	Value to enter			Value to enter	
Section 5.1	Fugitive or Non-Point Air Emissions	381.9	lb	Used these number over there>>>>>>	172.1 lb	554.0
Section 5.2	Stack or Point Air Emissions	2.1	lb		1.1 lb	3.2

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		All non 14, 34, 44	Cycle 14, 34, 44	
Section 5.4.1	On-site Underground Injection: Class I Wells	N/A	N/A	
Section 5.4.2	On-site Underground Injection: Class II-V Wells	N/A	N/A	
Section 5.5.1A	On-site Landfills: RCRA Subtitle C	N/A	N/A	
Section 5.5.1B	On-site Landfills: Other	N/A	N/A	
Section 5.5.2	On-site Land Treatment and Application Farming	N/A	N/A	
Section 5.5.3A	On-site Surface Impoundments: RCRA Subtitle C	N/A	N/A	
Section 5.5.3B	On-site Surface Impoundments: Other	N/A	N/A	
Section 5.5.4	Other Disposal	N/A	N/A	
Section 5.3	Water Bodies	N/A	N/A	
Section 6.1	POTW	N/A	N/A	
Section 6.2	Company that receives returned drums	BALCHEM CORP	BALCHEM CORP	
	Total quantity (lb)	4,376.0	512.0	4,888.0
	Basis of estimate	C - Mass balance	C - Mass balance	
	Waste Management Type	M26 - Other Reuse or Recovery	M26 - Other Reuse or Recovery	
Section 7A	On-site Waste Treatment Methods and Efficiency	RTO Desctruction of EO	RTO Desctruction of EO	
	Waste treatment efficiency range	99.9%	99.9%	
Section 7B	On-site Energy Recovery Methods and Quantity	N/A	N/A	
Section 7C	On-site Recycling Methods and Quantity	N/A	N/A	
Section 8.8	Non-Production Quantities	No	No	

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			For future reporting years, click the "Use Current Year			
Section 8.1a	Total On-site Disposal to Wells or Landfills	N/A	Quantities" box	N/A		
Section 8.1b	Total Other On-site Disposal or Other Releases	384.0 lb		173.1 lb		557.1
Section 8.1c	Total Off-site Disposal to Wells or Landfills	N/A		N/A		
Section 8.1d	Total Other Off-site Disposal or Other Releases	N/A		N/A		
Section 8.2	Quantity Used for Energy Recovery On-site	N/A		N/A		
Section 8.3	Quantity Used for Energy Recovery Off-site	N/A		N/A		
Section 8.4	Quantity Recycled On-site	N/A		N/A		
Section 8.5	Quantity Recycled Off-site	4,376.0 lb		512.0 lb		4,888.0
Section 8.6	Quantity Treated On-site	198,568.0 lb		25,595.9 lb		224,163.9
Section 8.7	Quantity Treated Off-site	N/A		N/A		
Section 8.9	Production Ratio or Activity Ratio	0.95		0.80		
Section 8.10	Source Reduction Activities	N/A		N/A		
	Barriers to Source Reduction	B7		B7		
Section 8.11	Optional Pollution Prevention Information	Can leave all blank		Can leave all blank		
Section 9.1	Miscellaneous Information	Can leave all blank		Can leave all blank		

Assumptions:						
EtO returned in each used drum	8.0 lb/drum		Initial weight (400 lb) - tare weight (18 lb) + manifold weight (10 lb) = 392 used per drum. Therefore, 8 lb/drum returned	8.0 lb/drum		
Product absorbtion	0.4%		Frank Davis memo Subject Ethylene Oxide, 9.apr.2019	2%		
EO degassing rate constant, k	0.06151 lb/hr		Frank Davis memo Subject Ethylene Oxide, 9/25/08	0.06151 lb/hr		

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Facility: Madison, GA **Use this to report 2018**

Reporting year: 2018

	All non 14, 34, 44		Cycle 14, 34, 44	
Miscellaneous fugitive loss	100 lb		0 lb	100
Calculations:				
Process inlet:				
Total drums used	497		64	561.0
Returned in drum	3,976.0 lb		512.0 lb	4,488.0
Returned in bad drums	400.0 lb		0.0 lb	400.0
Returned in partial bad drums	0.0 lb		0.0 lb	0.0
Total returns	4,376.0 lb		512.0 lb	4,888.0
Sterilizer:				
EO into sterilizers	198,952 lb		25,769 lb	224,721.0
EO absorbed by product	795.8 lb		515.4 lb	1,311.2
EO in sterilizer not absorbed by product	198,156.2 lb		25,253.6 lb	223,409.8
EO exhausted to RTO from vac/air wash	196,372.8 lb		25,026.3 lb	221,399.1
EO exhausted to RTO from vent	1,783.4 lb		227.3 lb	2,010.7
Sterilizer exhaust to RTO	198,156.2 lb		25,253.6 lb	223,409.8
Sterilizer exhaust removed by RTO	198,155.2 lb		25,253.5 lb	223,408.7
Sterilizer exhaust from RTO	1.0 lb		0.1 lb	1.1
Transfer:				
EO offgas during product transfer to aeration	0.51%	EO will off-gas from products during aeration per equation: $C = C_o e^{(-kt)}$, where C = Final EO concentration, C_o = EO concentration at time 0, k = EO degassing rate constant, and t = degassing time in hrs.	0.51%	
EO offgas during product transfer to aeration	4.1 lb		2.6 lb	6.7
Aeration:				

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Use this to report 2018

Reporting year: 2018

	All non 14, 34, 44		Cycle 14, 34, 44		
EO remaining in product entering aeration	791.7	lb	512.7	lb	1,304.5
Offgas during aeration, Cycle 7	64.9%		67.0%		
Offgas during aeration, Cycle 8	70.8%		67.0%		
Offgas during unloading	3.0%		3.0%		
EO offgas during aeration, Cycle 7	508.5	lb	0.0	lb	508.5
EO offgas during aeration, Cycle 8	5.5	lb	343.3	lb	348.7
EO offgas during aeration, total	513.9	lb	343.3	lb	857.2
To RTO during aeration	405.5	lb	338.2	lb	743.7
To RTO during vent	8.4	lb	5.1	lb	13.5
Total aeration to RTO	413.9	lb	343.3	lb	757.2
Aeration removed by RTO	412.8	lb	342.4	lb	755.2
Aeration exhaust	1.1	lb	0.9	lb	2.0
<u>In product:</u>					
EO in product	277.8	lb	169.5	lb	447.3
<u>Exhausted:</u>					
EO exhausted to atmosphere from RTO	2.1	lb	1.1	lb	3.2
Total removed by RTO	198,568.0	lb	25,595.9	lb	224,163.9
Total EO exhausted to atmosphere	106.2	lb	3.7	lb	109.9

Production ratio:

	Historical gas loads	Production ratio	Production ratio
2006	60		
2007	545	9.08	#DIV/0!
2008	1087	1.99	0.22
2009	1162	1.07	0.54
2010	1697	1.46	1.37
2011	1760	1.04	0.71

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		All non 14, 34, 44	Cycle 14, 34, 44
2012	1620	0.92	0.89
2013	1264	0.78	0.85
2014	1820	1.44	1.85
2015	1753	0.96	0.67
2016	2065	1.18	1.22
2017	1,953	0.95	0.80
2018	2421	1.24	1.31
2019			
2020			